AF/RCW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: Group Art Unit: 3726

Applicant: DEEPAK K. PAI ET AL Examiner: R. K. Chang

Serial No.: 10/765,201

Filed: January 28, 2004

Title: METHODS FOR FILLING HOLES IN PRINTED WIRING BOARDS

APPEAL BRIEF

Commissioner for Patents
Randolph Building
401 Dulany Street
Alexandria, VA 22314
Sir:

Further to Applicants' Notice of Appeal filed on December 24, 2008, herein follows Applicants' Appeal Brief for the above-captioned case.

I. Real Party in Interest

General Dynamics Advanced Information Systems, Inc.

II. Related Appeals and Interferences

None.

III. Status of Claims

Claims 1-9 are pending in the application. All have been twice rejected and are the subject of the instant appeal. The status of the individual claims is as follows:

1-3 and 9: rejected under 35 U.S.C. § 102 as anticipated by Bahrle;

4-9: rejected under 35 U.S.C. § 103 as obvious over Bahrle in view of Official Notice; and

10-32: withdrawn pursuant to a restriction requirement.

The rejections of claim 9 are inconsistent, in that claim 9 stands rejected as both anticipated by Bahrle and obvious over Bahrle in view of Official Notice. By telephone interview of December 17, 2008, the Examiner clarified that the rejection for obviousness is an alternative "fall back" position if Bahrle is not considered anticipating.

IV. Status of Amendments

All amendments to claims 1-9 as presented in the case have been entered.

V. Summary of Claimed Subject Matter

Independent claim 1 (the only pending independent claim) is generally directed to a method for filling a hole in a printed wiring board. As discussed in the background section of the instant application, prior art methods for filling holes in wiring boards are of limited effectiveness as the holes become smaller. The prior art, such as the primary Bahrle reference, creates holes in wiring boards, and lines the inner surface with a conductor, essentially forming a conductive hollow cylinder. If the hole needs to be filled, it is filled with an epoxy resin. This technique, however, is not particularly effective for smaller holes.

Independent claim 1, by way of summary, provides a method for filling a hole in a wiring board that is particularly effective for smaller holes. Below follows a non-limiting correspondence of claim terms of claim 1 with non-limiting examples of supporting disclosure in the specification.

1. A method for filling at least one hole (104) in a printed wiring board (collectively 101, 102 and 103), the method comprising the steps of:

providing a printed wiring board (collectively 101, 102 and 103) with a hole; (see, *e.g.*, Fig. 1A and 1B and pg. 8:4-11)

plating an inner surface of the hole in the board (collectively 101, 102 and 103) with a first conductor; (see, *e.g.*, Fig. 1C and pg. 8:2-16)

applying photoresist material (106 and 107) to a first side and a second side of the board (upper surface of 101 and lower surface of 103, respectively); (see, *e.g.*, Fig. 1D and pg. 8:17-20)

exposing a portion of the photoresist material (106) on the first side of the board (upper surface of 101) to developing light, wherein the portion (region of 108) of the photoresist material (106) on the first side of the board (upper surface of 101) that is not exposed to developing light

covers an opening (108) of the hole (104) on the first side of the board (upper surface of 101); (see, *e.g.*, pg. 8:21-9:1)

exposing the photoresist material (107) on the second side of the board (lower surface of 103) to developing light; (see, *e.g.*, pg. 8:21-9:1)

washing the board to remove unexposed photoresist material (106, 107), wherein the unexposed photoresist material (region of 108) that covers the opening of the hole (104) on the first side of the board (upper surface of 101) is removed; (see, *e.g.*, Fig. 1E, pgs. 4:5-11 and 8:21-9.1); and

filling the hole (104) in the board with a second conductor (109); (see, *e.g.*, Fig. 1F and pg. 9:4-7)

wherein the photoresist material (106, 107) substantially prevents the second conductor (109) from contacting the first and second sides of the board (upper surface of 101, lower surface of 103) during said filling. (see, *e.g.*, Fig. 1F pg. 9:4-7).

VI. Grounds of Rejection to be Reviewed on Appeal

Applicants appeal the specific rejections of:

1, 3 and 9 as rejected under 35 U.S.C. § 102 as anticipated by Bahrle; and

4-9 as rejected under 35 U.S.C. § 103 as obvious over Bahrle in view of Official Notice.

Claim 2 rises and falls with respect to claim 1, and is not independently advanced in this appeal.

Claims 4-8, while each having differing scope, present the same common issue and thus rise and fall together.

V. Argument

For convenience of discussion and flow of issues, Applicants herein address the rejections of claims in the following order: 1, 9, 3 and 4-8.

A. Claim 1

Claim 1 recites as follows:

> 1. A method for filling at least one hole in a printed wiring board, the method comprising the steps of:
> providing a printed wiring board with a hole;
> plating an inner surface of the hole in the board with a first conductor;
> applying photoresist material to a first side and a second side of the board;
> exposing a portion of the photoresist material on the first side of the board to developing light, wherein the portion of the photoresist material on the first side of the board that is not exposed to developing light covers an opening of the hole on the first side of the board;
> exposing the photoresist material on the second side of the board to developing light;
> washing the board to remove unexposed photoresist material, wherein the unexposed photoresist material that covers the opening of the hole on the first side of the board is removed; and
> <u>filling the hole in the board with a second conductor;</u>
> <u>wherein the photoresist material substantially prevents the second conductor from contacting the first and second sides of the board during said filling.</u>

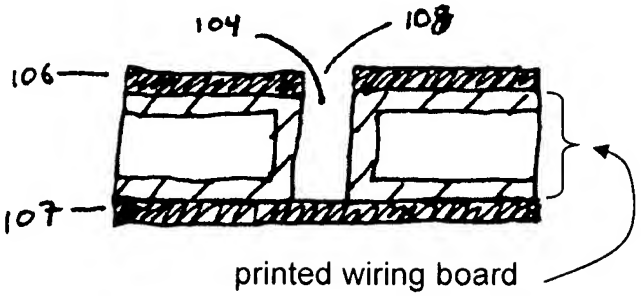
The emphasized limitations in claim 1 represent those claim terms that are not present in the applied Bahrle reference, such that the anticipation rejection is improper and should be reversed.

1. <u>Bahrle does not disclose "filling the hole in the board with a second conductor"</u>

Claim 1 recites the step of "filling the hole in the board with a second conductor." U.S. Patent No. 4,705,592 ("Bahrle") discloses a hole 3 with a small quantity of copper 6 therein that

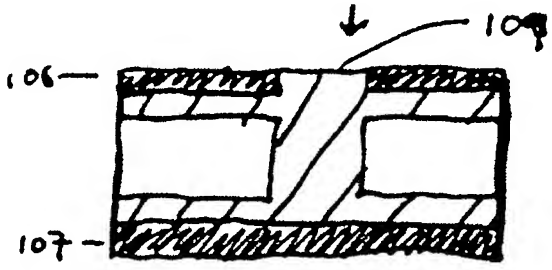
coats the sides of the hole 3. The point of contention is whether this coating of copper 6 is "filling" the hole 3 as recited in Applicants' claim 1.

The difference of opinion between Applicant and the Examiner appears to be what is required by the language "filling" the hole. The claim 1 language preceding the "filling" step placed the printed wiring board in a state in which there is a hole 104 in the printed wiring board[1], and photoresist 106/107 on the outer sides of the printed wiring board with an opening(s) 108 in the photoresist to access the hole. A non-limiting example of this is shown in application Fig. 1E (shown annotated to the right).



Application Fig. 1E

The above claim 1 language transitions into the noted "filling the hole in the board with a second conductor." Non-limiting corresponding language in the specification is as follows: "The holes in the PWBs of the invention may be completely filled, substantially filled, or plated using the method of the invention." (pg. 5:13-14); and "FIG. 1F shows the two-layer PWB after the hole has been filled with copper 109." (pg. 9:4.). Fig. 1F of the application, (shown to the right), depicts the second conductor 109 completely occupying the space of the hole 104 (and indeed exceeding the dimensions of the hole with a nodule of additional material; 9:4-7).



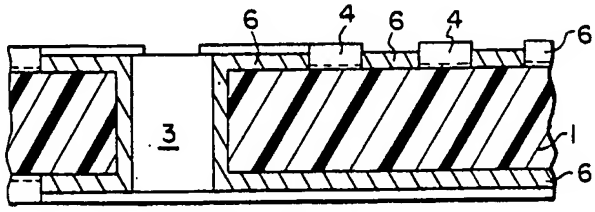
Application Fig. 1F

[1] The application does not have a specific reference designator for the printed wiring board. Rather, the non-limiting embodiments describe it as made of several constituent layers show in an embodiment as 101, 102 and 103. The invention is not limited to any particular type of printed wiring board.

Applicants submit that the above-disclosure teaches that "filling the hole in the board with a second conductor" for purposes of appeal refers to adding an amount of the second conductor to the hole such that the second conductor "completely or substantially" occupies the entire hole. In this context, "completely" filling would require the entire capacity of the hole to be occupied by the second conductor (potentially with excess second conductor extending beyond the hole). "Substantially full" per the ordinary meaning of "substantially" allows for some degree of flexibility from the perfection of "completely," but still requires the second conductor to be present in an amount that is at or near capacity of the hole.[2]

The above definition of "filling" is consistent with dictionary definitions of "filling" and "fill." *See, e.g., The American Heritage® Dictionary of the English Language* (4th ed. 2000) ("fill: . . . **1a.** To put into (a container, for example) **as much as can be held**: *fill a glass with milk.* **b.** To supply or provide **to the fullest extent**: *filled the mall with new stores.*"). These ordinary meaning definitions communicate a common concept of fullness, in that the container subject to the filling is brought at or near capacity with whatever the filler is.

We now compare the claim 1 language "filling the hole in the board with a second conductor" with the applied Bahrle patent. As shown in Bahrle Figs. 1F, (shown on the right) a printed wiring board 1 has a hole 3 therein. The inner surface of the Bahrle hole 3 is coated with a



Bahrle Fig. 1F

[2] *Deering Precision Instruments L.L.C. v. Vector Distribution Systems Inc.*, 347 F.3d 1314, 1323 (Fed. Cir. 2003) ("Indeed, our cases recognize the dual ordinary meaning of [substantially] as connoting a term of approximation or a term of magnitude.")

copper layer 6.[3] Most of the top and bottom sides of the Bahrle printed wiring board 1 is also covered with Bahrle copper layer 6 save for limited areas protected by a photoresist 4.

In support of the rejection, the Office Action apparently takes the position that Bahrle hole 3 equates with Applicants' claim 1 "hole," and that Bahrle copper layer 6 equates to Applicants' claim 1 "second conductor." To meet the noted language "filling the hole in the board with a second conductor," Bahrle would need to teach that Bahrle cooper layer 6 occupies nearly all or all of the volume of Bahrle hole 3. Clearly this is not the case, as Bahrle Fig. 1F shows that the copper layer 6 occupies only a small portion of the capacity of the hole.[4] This is clearly not an at or near capacity filling as required by Applicants' claim 1.

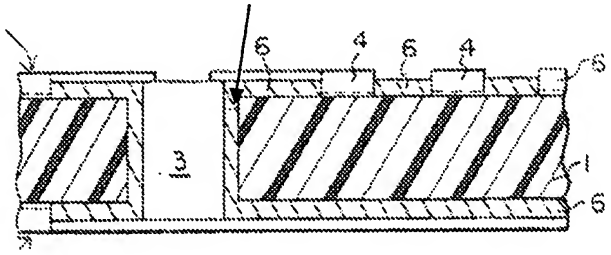
Applicants made this same point to the Examiner earlier in the prosecution. The Examiner's written response, with minimal analysis, is an annotation of Bahrle Fig. 1F and a single sentence in the remarks, as follows:

The examiner maintains his rejection.

Bahrle's hole 3 is filled with 6.

6/30/08 OA at 4

Substantially filled with 6



6/30/08 OA at 3

[3] As shown in Bahrle Fig. IE, a prior layer of copper 5 coats these same surfaces and merges with the subsequent application of copper 6 in Fig. 1F.

[4] Bahrle does not provide guidance as to the dimensions and/or formation methodologies to determine or even estimate how much capacity of hole 3 copper layer 6 takes up. Since patent drawings are not considered to scale for rejection purposes, no specific numbers can be derived from Bahrle Fig. 1F. Nonetheless, Applicants submit that Bahrle Fig. 1F teaches that the copper layer 6 only serves as a coating to the inner surfaces of the Bahrle hole 3, and that the overwhelming bulk of the main cavity that defines hole 3 is empty.

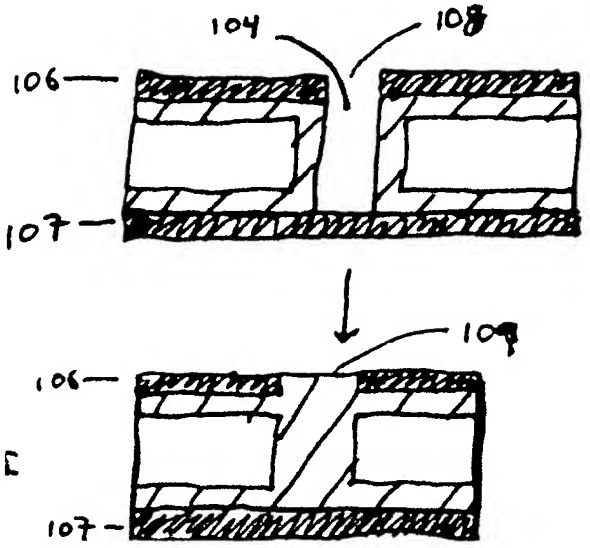
Applicants submit that the assertion that Bahrle hole 3 is "substantially filled" by Bahrle copper layer 6 is untenable. Certainly Bahrle cooper layer 6 is inside Bahrle hole 3, coats the walls of hole 3, and occupies some of the volume of hole 3. But it is equally certain from Bahrle Fig. 1F that Bahrle copper layer 6 occupies only a minimal portion of the volume of Bahrle hole 3. This amount of copper layer 6 nowhere approaches a quantity at or near the capacity of hole 3; indeed, Bahrle hole 3 is far closer to substantially empty than to substantially full.

For the above reasons, Bahrle does not disclose the claimed step of "filling the hole in the board with a second conductor" as recited in claim 1. On this independent basis, the Examiner's rejection for anticipation cannot be maintained and should be reversed.

2. Bahrle fails to teach "wherein the photoresist material substantially prevents the second conductor from contacting the first and second sides of the board during said filling."

Claim 1 recites "applying photoresist material to a first side and a second side of the board," and "wherein the photoresist material substantially prevents the second conductor from contacting the first and second sides of the board during said filling." As discussed above, Bahrle shows isolated blocks of photoresist 4 on the top and bottom sides of its printed wiring board 1. The primary point of contention is whether the Bahrle photoresist 4 "substantially prevents" the Bahrle copper layer 6 (which as discussed above the Office Action equates with the claimed "second conductor" that is provided via the "filling step) from contacting the sides of its printed wiring board 1.

The difference of opinion between Applicant and the Examiner appears to be what is meant for purposes of appeal by the language "substantially prevents." Relevant non-limiting disclosure is found in the application at 9:4-7 and Figs. 1E and 1F. As shown in Fig. 1E, the photoresist 106 and 107 covers both of the top and bottom sides of the printed wiring board, save the opening 108 to the hole 104. When the hole 104 is filled with the second conductor 109 in Fig. 1F, the photoresist layers 106 and 107 act as a barrier that does not allow the second conductor 109 to reach the sides of the printed wiring board. As disclosed in the application at 9:4-7, any excess conductor 109 that would in the prior art methodology flow into the sides of the printed wiring board instead flow over onto the photo resist layers 106 and 107.



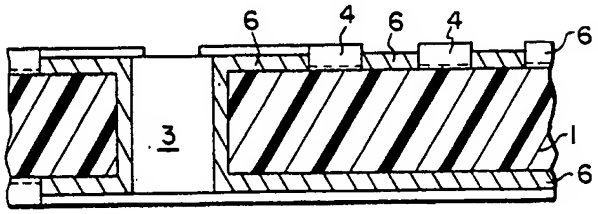
This above-noted disclosure shows that the claim language is self-explanatory, in that the photoresist acts as a barrier, and blocks all or nearly all of the second conductor from reaching the sides of the wiring board during filling. (The additional term "substantially" carries its ordinary meaning and allows for some flexibility relative to perfection, and thus the "nearly all.")[5]

We now compare the claim 1 language "wherein the photoresist material substantially prevents the second conductor from contacting the first and second sides of the board during said filling" with the applied Bahrle patent. To meet this claim language, the Bahrle photoresist 4

[5] The establishment of photoresist patterns is well known to be based on masks. In many cases it can be expected that the opening in the mask used to define opening 108 in the photoresist 106 will not be in absolute perfect alignment due to, *e.g.*, mechanical tolerances. "Substantially," by way of example, accounts for such imperfections.

would need to block or all or nearly all of the Bahrle copper layer 6 (which the Office Action equates with the claimed "second conductor") from reaching the upper and lower sides[6] of the Bahrle wiring board 1 during filling.

Simple physical inspection of Bahrle Fig. 1F shows that this is not the case. The photoresist 4 has limited coverage on the top and bottom sides of the printed wiring board. The Bahrle copper layer 6 thus overflows from the hole 3 onto all surrounding areas of the sides of Bahrle printed wiring board 1. Photoresist 4 provides minimal coverage to the left of hole 3 on either the top or bottom sides. Photoresist 4 provides no coverage at all on the bottom side to the right of hole 3. Overall, Bahrle Fig. 1F shows that only 15% of the surface area of the sides of the printed wiring board 1 is protected by the photoresist 4, while copper layer 6 is in direct contact with some 85% of the printed wiring board 1 in Bahrle Fig. 1F.



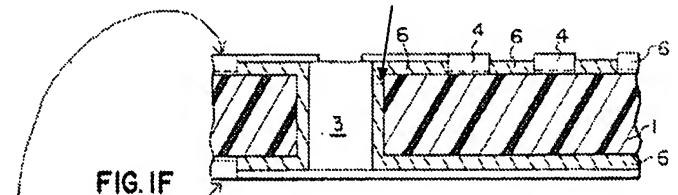
Bahrle Fig. 1F

This is the exact opposite of the claim language. Specifically, claim 1 recites that the photoresist "substantially prevents" the second conductor from contacting the first and second sides of the printed wiring board. In contrast, the Bahrle photoresist 4 provides *substantial access* to the copper layer 6 to reach the sides of the wiring board 1.

[6] Claim 1 is not specific to whether the claimed first and second sides are lower and upper sides. However, claim 1 recites that the photoresist is on first and second sides, which both the embodiments of the application and Bahrle show as the upper/top and lower/bottom sides. The reference to upper, top, bottom and lower is thus for convenience and ease of discussion, but is not intended to limit the scope of Applicants' claims.

Applicants made this same point to the Examiner earlier in the prosecution. The Examiner's written response, again with minimal analysis, is an annotation of Bahrle Fig. 1F and a single sentence in the remarks, as follows:

> As shown above, 4 covers the hole 3 and substantially prevents the second conductor from contacting the sides.
>
> 6/30/08 OA at 4



6/30/08 OA at 3

The Examiner's position is clearly belied by the Bahrle Fig. 1F. While it is true that in the prior step shown in Bahrle Fig 1E, photoresist 4 extends partially over hole 3, this portion of photoresist 4 clearly does not survive subsequent processing to the state of Fig. 1F, and did not prevent the copper layer 6 from making significant contact with the upper and lower sides of the printed wiring board 1.[7] Thus, the claim language of "substantially prevents" is simply not met.

For the above reasons, Applicants submit that Bahrle does not disclose "wherein the photoresist material substantially prevents the second conductor from contacting the first and second sides of the board during said filling" as recited in claim 1. On this independent basis, the Examiner's rejection for anticipation cannot be maintained and should be reversed.

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[7] Examination of Bahrle Figs. 1E and 1F also appear inoperable, thereby raising an enablement challenge to the reference as prior art. Specifically, Bahrle describes Fig. 1D as the state when photoresist is applied, and Fig. 1E after photoresist is developed. Bahrle 5:42-63. Yet when copper layer 6 is added in Fig. 1F, it penetrates *beneath* some of the photoresist 4 (*e.g.*, in the areas around the hole 3) leaving unnumbered rectangles above copper layer 6, but has no effect on other portions of the photoresist. Applicants are unaware how this occurs, as nothing in the Bahrle disclosure addresses or indicates how copper layer 6 is forming beneath the photoresist. In any event, Bahrle Fig. 1 F nonetheless shows that cooper layer 6 is in substantial contact with the sides, and therefore cannot meet the noted claim language.

Accordingly, claim 1 recites at least two features which are not found in the applied Bahrle reference. Reversal of the rejection of claim 1 and allowance of the same are therefore requested.

B. Claim 9

Claim 9 has been rejected under 35 U.S.C. § 102 as anticipated by Bahrle and under 35 U.S.C. § 103 as obvious over Bahrle. Applicants request reversal of both rejections.

Claim 9, which depends from claim 1, recites "wherein the hole is substantially filled with the second conductor." This language is thus a natural extension of the filling step of claim 1, in that claim 9 expressly recites the result that the hold is "substantially filled." The interpretation of this term is akin to that discussed with respect to claim 1, in that the second conductor occupies all or nearly all of the volume created by the hole. For the reasons discussed with respect to claim 1, Bahrle fails to disclose this claim language. Bahrle's hole 3 is substantially empty, not substantially filled by its copper layer 6.

Applicants also note that, to the extent that "filling" in claim 1 is interpreted to include some state of volume that is less than all or nearly all of the volume of the hole, then claim 9 would effectively narrow the scope of claim 1 to a state in which all or nearly all of the volume of the hole is occupied by the second conductor. Clearly this is not the case in Bahrle, and the anticipation rejection cannot be maintained. Indeed, that the Office Action rejects claim 9 on both anticipation grounds and obviousness grounds relating to whether the hole is filled or not telegraphs that the Examiner perceives the weakness in his position.

With respect to the obviousness rejection, the Examiner takes Official Notice that it is well-known to fill a hole. Applicants submit that this is a superficial perspective that is unhelpful in the analysis of claim 9. Certainly a pirate who digs a hole for treasure would

find it obvious to fill the hole when done. In contrast, a miner who digs a hole to reach a chamber would consider it counter-intuitive to fill the hole. The question is thus not whether it is obvious to fill a hole in the abstract, but whether (1) it is obvious to fill Bahrle hole 3, and (2) even if so, whether it is obvious to fill the hole 3 with the second conductor.

Applicants submit that the Bahrle hole 3 is akin to the miner analogy rather than the pirate analogy. Bahrle is, effectively, a teaching of how to make a circuit board with a hole in it. It goes to great lengths to create the hole, and then to preserve the hole. Indeed, such holes are necessary to preserve so that they can later support insertion of electronic components. To simply declare that it would be obvious to fill the hole with conductor that Bahrle spent an entire patent creating effectively eviscerates Bahrle's teachings, creating a circuit board with no holes in it. The proposed modification to fill the Bahrle hole 3 is thus illogical, and thus not suggested by the reliance on Official Notice.

In addition, with reference to the Background section of the instant application, Bahrle is a known prior art method in which metal is plated to the sides of a drilled hole, forming a metal cylinder. Application at 2:11-3:3. When such holes in the prior art needed to be filled, it was filed with an epoxy resin. Application at 3:3-3:9. Thus, even if one were motivated to fill the Bahrle hole 3, the industry focus would have been to fill the hole with epoxy, not conductive material as recited in claim 9, and certainly not the second conductor of the filling step as recited in claim 9.

Accordingly, claim 9 is patentably distinct over the applied art. Reversal of the rejection is therefore requested.

C. Claim 3

Claim 3, which depends from claim 1, has been rejected under 35 U.S.C. § 102 as anticipated by Bahrle. Applicants request reversal of the rejection. Claim 1 recites "plating an inner surface of the hole in the board with a first conductor." Claim 3, which depends from claim 1, further recites "wherein the plating step is electroplating." Bahrle does not teach electroplating, and in fact teaches directly away from electroplating.

"Electroplating" is a well known method of coating an object by passing an electric current through it. Thus, the combination of claims 1 and 3 requires that the inner surface of the hole be plated with a first conductor via the application of electric current (*i.e.*, electroplating). This differs from sputtering, which typically involves physical vapor deposition, and for which no electricity is applied. Sputtering is therefore not electroplating, and vice versa, and therefore does not meet the language of claim 3.

The Office Action equates the Bahrle copper layer 5 (shown in dashed lines beginning in Bahrle Fig. 1C, and which precedes the formation of the "second conductor" copper layer 6 shown in Bahrle Fig. 1F) with the claimed "first conductor." Bahrle clearly states that copper 5 is added by sputtering. Bahrle 5:20-23. As discussed above, sputtering is not electroplating. Bahrle therefore fails to teach electroplating the first conductor as recited in claim 3, such that rejection for anticipation may not be properly maintained.

In anticipation of a counter argument that electroplating is an obvious variation over sputtering, Bahrle expressly states that creating micron-thick copper layers on circuit boards requires "electroless plating": "**Electroplating cannot be used** to deposit the copper because the conductive material deposited on the hole walls during activation is not thick enough to allow for a continuous current adequate for electroplating." Bahrle 2:31-37 (emphasis

added). The Bahrle copper layer 5 which is equated with the claimed first conductor is only 80-500 nm thick, or 0.08-0.5 microns. Bahrle 5:25-26. Bahrle copper layer 5 is thus well thinner than the dimensions which Bahrle identified as inappropriate for electroplating. One of skill would therefore not be motivated to modify application of Bahrle's copper layer 5 with electroplating instead of sputtering when Bahrle itself states that it cannot be used.

The Office Action nonetheless rejects claim 3 on the rationale that Bahrle at 3:4-20 discloses electroplating, and that "further electroplated layer is further electroplated with copper to reinforce for more current to flow between the two surfaces." The Examiner's citation and rationale (which is effectively just a paraphrase of Bahrle 3:4-20) is taken from Bahrle's discussion of a prior art method; essentially the Examiner located the term "electroplating" in Bahrle and threw it into the hat without any consideration of whether it applied or not to Bahrle's copper layer 5. Clearly it is the latter, as the electroplating step of the prior art has no relationship to copper layer 5 of Bahrle's disclosed embodiment. To the contrary, Bahrle 3:4-20 teaches that the first layer of copper in the prior art method – which corresponds to the Bahrle copper layer 5 - is sputtered to a thickness of 0.5 microns. This is consistent with Bahrle's observation that these layers are too thin for electroplating application.

Accordingly, Bahrle does not disclose "electroplating" the first conductor as recited in the combination of claims 1 and 3. Withdrawal of the rejection and allowance of the same are therefore respectfully requested.

D. Claims 4-8 are patentably distinct over Bahrle.

Claims 4-8 recite as follows:

4. The method of claim 1, wherein the diameter of the hole is less than about 0.02 inches.

5. The method of claim 4, wherein the diameter of the hole is less than about 0.01 inches.

6. The method of claim 1, wherein the diameter of the hole is less than about 0.02 inches, and an aspect ratio of the hole is greater than about 7.

7. The method of claim 1, wherein the aspect ratio of the hole is greater than about 7.

8. The method of claim 7, wherein the aspect ratio of the hole is greater than about 10.

Each of the above claims has the common feature of specifically reciting a dimensional characteristic of the claimed hole. There is no allegation that Bahrle teaches these dimensions for its hole 3. Thus claims 4-8 stand rejected under 35 U.S.C. § 103 under Bahrle in view of Official Notice. The Official Notice is essentially a boiler plate MPEP citation to *In re Aller* that when "general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involved only routine skill in the art." *See* MPEP § 2144.05 (quoting *In re Aller*, 220 F.2d 454, 456 (CCPA 1995)).

The flaw in the rationale of the rejection is that Bahrle does not show the general conditions of Applicants' claim 1, such that claims 4-8 are not obvious variants within some workable range. Specifically, while Bahrle does not disclose the size of its holes 3, its 1985 priority date suggests that they were considerably larger (per the technology of the time) than those recited in claims 4-8. While some miniaturization of the design can fairly be implied under *In re Aller*, the dimensions recited in claims 4-8 are miniaturization to a degree that would render the Bahrle circuit board fragile, and for which available epoxy reinforcement techniques would

be inadequate. Application at 3: 1-9. Stated in another way, the dimensions of the holes recited in claims 4-8 are well outside the "workable ranges" that could be fairly attributable to Bahrle.

Thus, even if the rejection of claim 1 was affirmed, the fact remains that Bahrle is still a hollow-cylinder-based technology that lacks structural integrity and which cannot stand up to the dimensions recited in claims 4-8. There is thus no motivation to modify Bahrle to the dimensions recited in claims 4-8.

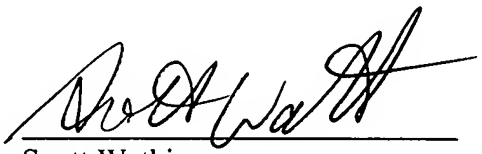
Accordingly, claims 4-8 are patentably distinct over the applied art. Reversal of the rejection is therefore requested.

VI. Conclusion

For all the foregoing reasons, Appellant therefore respectfully requests that this Honorable Board reverse the rejections and allow all claims 1-9 herein.

Respectfully submitted,

STEPTOE & JOHNSON, L.L.P.



Date: February 23, 2009

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CLAIMS APPENDIX

1. (Previously Presented) A method for filling at least one hole in a printed wiring board, the method comprising the steps of:

providing a printed wiring board with a hole;

plating an inner surface of the hole in the board with a first conductor;

applying photoresist material to a first side and a second side of the board;

exposing a portion of the photoresist material on the first side of the board to developing light, wherein the portion of the photoresist material on the first side of the board that is not exposed to developing light covers an opening of the hole on the first side of the board;

exposing the photoresist material on the second side of the board to developing light;

washing the board to remove unexposed photoresist material, wherein the unexposed photoresist material that covers the opening of the hole on the first side of the board is removed; and

filling the hole in the board with a second conductor;

wherein the photoresist material substantially prevents the second conductor from contacting the first and second sides of the board during said filling.

2. (Previously Presented) The method of claim 1, wherein the first conductor is copper.

3. (Original) The method of claim 1, wherein the plating step is electroplating.

4. (Original) The method of claim 1, wherein the diameter of the hole is less than about 0.02 inches.

5. (Original) The method of claim 4, wherein the diameter of the hole is less than about 0.01 inches.

6. (Previously Presented) The method of claim 1, wherein the diameter of the hole is less than about 0.02 inches, and an aspect ratio of the hole is greater than about 7.

7. (Original) The method of claim 1, wherein the aspect ratio of the hole is greater than about 7.

8. (Original) The method of claim 7, wherein the aspect ratio of the hole is greater than about 10.

9. (Previously Presented) The method of claim 1, wherein the hole is substantially filled with the second conductor.

10. (Withdrawn) A printed wiring board comprising a filled hole, wherein the filled hole is filled by the method of claim 1.

11. (Withdrawn) A printed wiring board comprising a filled hole, wherein the filled hole is filled by the method of claim 2.

12. (Withdrawn) The printed wiring board of claim 10, wherein the diameter of the filled hole is less than about 0.02 inches.

13. (Withdrawn) The printed wiring board of claim 12, wherein the diameter of the filled hole is less than about 0.01 inches.

14. (Withdrawn) The printed wiring board of claim 10, wherein the aspect ratio of the filled hole is greater than about 7.

15. (Withdrawn) The printed wiring board of claim 14, wherein the aspect ratio of the filled hole is greater than about 10.

16. (Withdrawn) The printed wiring board of claim 10, wherein the hole is substantially filled with the conductor.

17. (Withdrawn) An apparatus for filling at least one hole in a printed wiring board, the apparatus comprising:

a means for applying photoresist material to a first side and a second side of the board;

a means for exposing a portion of the photoresist material on the first side of the board to developing light, wherein the portion of the photoresist material on the first side of the board that is not exposed to developing light covers an opening of the hole on the first side of the board;

a means for exposing the photoresist material on the second side of the board to developing light;

a means for washing the board to remove unexposed photoresist material, wherein the unexposed photoresist material that covers the opening of the hole on the first side of the board is 5 removed;

a means for plating the inner surface of the hole in the board with a conductor;

wherein the photoresist material substantially prevents the conductor from being plated on the first and second sides of the board.

18. (Withdrawn) The apparatus of claim 17, wherein the conductor is copper.

19. (Withdrawn) The apparatus of claim 17, wherein the plating step is electroplating.

20. (Withdrawn) The apparatus of claim 17, wherein the diameter of the hole is less than about 0.02 inches.

21. (Withdrawn) The apparatus of claim 20, wherein the diameter of the hole is less than about 0.01inches.

22. (Withdrawn) The apparatus of claim 17, wherein the aspect ratio of the hole is greater than about 7.

23. (Withdrawn) The apparatus of claim 22, wherein the aspect ratio of the hole is greater

than about 10.

24. (Withdrawn) The apparatus of claim 17, wherein the hole is substantially filled with the conductor.

25. (Withdrawn) A method for filling holes in a printed wiring board, comprising:

providing a board including at least a first conductive layer, a second insulating layer; and a third conductive layer;

creating a hole concentrically in said first, second, and third layers;

applying a first conductive material to an inner surface of said hole;

applying a photoresist on the first and third layers;

removing the photoresist in the first layer in an area above said hole;

filling the hole with a second conductive material; and

removing the photoresist;

wherein the photoresist substantially prevents said second conductive material from adhering to unexposed portions of said first layer.

26. (Withdrawn) The method of claim 25, wherein said filling results in said conductive material being electrically connected to said first and third layers.

27. (Withdrawn) The method of claim 25, wherein said applying comprises plating.

28. (Withdrawn) The method of claim 27, wherein said plating comprises applying an electrical potential between said first and third layers.

29. (Withdrawn) A method for filling holes in a printed wiring board, comprising:

providing a printed wiring board;

creating a hole in said printed wiring board;

applying a first conductive material to an inner surface of said hole;

applying a photoresist on first and second opposing sides of said printed wiring board;

removing the photoresist in the first side in an area above said hole;

filling the hole with a second conductive material; and

removing the photoresist;

wherein the photoresist substantially prevents said second conductive material from adhering to unexposed portions of said first side.

30. (Withdrawn) The method of claim 29, wherein said filling results in said conductive material being electrically connected to said first and third layers.

31. (Withdrawn) The method of claim 29, wherein said applying comprises plating.

32. (Withdrawn) The method of claim 31, wherein said plating comprises applying an electrical potential between said first and third layers.

RELATED PROCEEDINGS APPENDIX

None.

EVIDENCE APPENDIX

None